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COLLEGE OF ARTS AND SCIENCES

LEADERSHIP, TRAINING, AND GENDER INFLUENCES ON TEAM DECISION MAKING

By

MEGAN E. BIRD

A Thesis submitted to the
Department of Psychology
in partial fulfillment of the
requirements for the degree of
Master of Science

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The members of the Committee approve the thesis of Megan E. Bird, defended on 8 May, 1997.

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ABSTRACT

This study explored the effects of gender of the leader, gender of the non-leader, and whether the leader or non-leader was trained on team decision making while solving a computerized Tower of Hanoi puzzle. The experiment involved one hundred and ninety two undergraduate students combined into 96 two-person teams. The design combines gender of the leader, gender of the non-leader, and whether the leader or non-leader was provided prior relevant training, resulting in 8 experimental conditions with 12 teams in each condition. Analysis of variance yielded significantly quicker times to solve the puzzle for those teams with a male non-leader versus a female non-leader. Teams with male non-leaders also proved to have shorter average times per move while completing the puzzle than teams with female non-leaders. When females are the non-leader of the team, they are less likely to introduce valuable information to the decision making process than when males are the non-leader. When examining same gender teams, female-female teams exhibited significantly longer total times and average times per move than male-male teams.

Among the female-female teams, those teams with the leader trained were significantly faster in average time per move than those teams where the non-leader was trained. The gender differences found in this study are consistent with other research.

LEADERSHIP, TRAINING, AND GENDER INFLUENCES ON TEAM DECISION MAKING

Team decision making is the cornerstone of many organizational successes. The advent of the Total Quality Management (TQM) movement brought with it a new paradigm for decision making. Critical decisions were being pushed to the lowest levels in the organization and work was organized around teams and team decisions. Members of the team bring with them expertise from their functional area in the organization. Schonberger (1992) declares that TQM uses multi-functional teams to help focus employees on continuous improvement of the organization. Team work groups, the most commonly utilized technique of companies practicing TQM, are used to identify, analyze and solve organizational problems (Hackman & Wageman, 1995). Typically, a team leader is established to organize the team and direct the decision making process. Little research has been conducted on the dynamics of teams and what factors impact team decision making.

There is a difference between the composition of a team and a simple group of individuals. In a team, the members are highly interdependent, have a common goal, and all of the members influence the decision making (Hollenbeck, Ilgen, Sego, Hedlund, Major, & Phillips, 1995). It is important to note that individuals on a team might have different agendas, perceptions and motivations all of which impact the team decision making process (Orasanu & Salas, 1992). Based on the this definition of teams, it is clear that many organizations are using teams to make critical decisions. The General Accounting Office, released a report in 1991 showing that those companies applying the concepts of TQM, including cross-functional problem solving teams, encountered improvement in overall organizational performance rated on several scales including profit, productivity, and customer satisfaction (Schonberger, 1992). Realizing the importance of effective team decision making, further research into the factors that effect the team's performance are essential for continued organizational success.

One such study was conducted by Hollenbeck et al. (1995) who investigated teams with team members varying in status and expertise to develop a theory of team decision making. Each team was composed of a team leader and three

staff members. Each team member had knowledge about different components of the task representing varying levels of expertise, but the team leader had the final say in all decisions made by the team. The key to successful completion of the task was each member sharing relevant information with the team leader so the leader could make an informed decision.

Based on their findings, Hollenbeck et al. (1995) proposed a theory for team decision making that makes predictions about team performance. This theory identifies three critical components, the degree team members could identify the relevant informational cues, the ability of team members to make accurate judgments, and the ability of the leader to weigh inputs from the team members, as primary predictors of team performance. One of the purposes of the current study was to determine how teams integrate differential knowledge on the part of team members who are arbitrarily designated as team leaders or non-leaders.

Studying decision making in real world naturalistic settings is often seen as the optimal method of study because it provides the opportunity to witness actual decisions being made which increases the generalizability of the findings. These natural environments provide dynamic settings with authentic stressors during the decision making

process. However, using natural environments for studying decision making is not practical for many reasons. For example, the dynamic environments are very hard to replicate. Depending on the scenario, it might be cost prohibitive or dangerous to conduct an experiment in a natural occurring environment. It is also difficult to isolate and control for specific variables affecting the decision making. For all of these reasons, the study of decision making often takes place in the laboratory.

On the other hand, there are benefits to using laboratory settings to study decision making. In the laboratory, there is much greater control over the variables impacting the decision making since many extraneous factors can be controlled and only the relevant variables manipulated and studied. In choosing such a viable analog situation, the present study utilized the Tower of Hanoi to study team decision making.

The Tower of Hanoi is a tool often used to study decision making. The puzzle consists of three vertical dowels or pegs and a number of disks that vary in size and fit on the pegs. To begin, the disks are arranged from largest (on the bottom) to smallest on one of the outer pegs. The goal is to move all of the pegs from one outer peg to the other outer peg. There are two rules that apply

to disk movement. First, only one disk may be moved at a time and it must be on the top of a stack. The second rule is that larger disks may not be placed on top of smaller disks.

While most published research on the Tower of Hanoi has used it as a tool for understanding individual decision making, unpublished dissertation work completed by Jack Barker (1995) employed the Tower of Hanoi as a method for understanding team decision making. In this research, members of two-person teams were given either relevant practice (on a four-disk tower) or irrelevant practice (on a form of the Eight Puzzle) prior to working cooperatively in solving a computerized five-disk tower problem. This research found the Tower of Hanoi to be an acceptable model for studying team decision making.

Barker (1995) trained one of the individuals on a four-disk tower prior to the team decision making task. The training should have improved team performance relative to teams in which neither member received relevant training. The study revealed that training did improve performance for teams with male members who received relevant practice, but not for teams in which female members received the same practice (Barker, 1995). Barker's findings may be related to a similar finding that males perform better than females

when performing individually on a computerized Tower of Hanoi task (Leon-Carrion, Morales, Forastero, Dominguez-Morlaes, Murillo, Jimenez-Baco & Gordon, 1991). This unresolved question as to why females don't bring information received from relevant practice to the team task may be related to learning effective strategies.

Leon-Carrion et al. (1991), found that females took more moves and longer total time to solve the computerized Tower of Hanoi. The authors attributed this difference to females choosing different strategies to solve the puzzle than males (Leon-Carrion et al., 1991). Barker (1995) also found that females, in contrast to males, were not learning effective strategies in the practice session that enabled them to solve the team task quicker.

The differences between male and female performance on a computerized Tower of Hanoi problem can also be credited to males performing better than females on spatial tasks. Stumpf & Eliot (1995) found evidence of differences between males and females on spatial tasks with males performing better on manipulation tasks requiring several steps to solve. Additional research (Harshman & Paivio, 1987) revealed the finding that in solving a problem, males are more able to visualize moving objects and are better able to break down an image into smaller parts than females.

In an attempt to clarify why teams with females receiving relevant practice were not performing any better than teams with females receiving irrelevant practice (Barker, 1995), the author conducted a series of pilot studies. This work first focused on teaching the individual female team members the strategies that would help them solve the puzzle. In addition to the irrelevant and relevant practice conditions employed by Barker (1995), an extensive practice group was added to the design. Using only female participants, the extensive practice included instructions that identified specific strategies to solve the Tower of Hanoi puzzle including the move-pattern strategy (Simon, 1975), a moving strategy for the disks based on whether there is an odd or even number of disks. This strategy also includes directions for the optimal moving pattern for the smallest disk.

For the extensive practice condition, the experimenter explained and demonstrated both strategies using the 4-disk wooden Tower of Hanoi before the practice session began. However, the addition of the extensive practice condition again revealed no practice effects with regard to the team problem solution. Using eleven teams in each of the conditions, there were no statistical differences found in the number of moves or the total time to complete the

5-block computerized task between the irrelevant, relevant, or extensive practice conditions. In short, the females with more extensive pre-training did not bring the strategies they learned to the team task.

Additional pilot work expanded the instructions even further in the extensive practice condition. In the second pilot study, the participants were told that they were taking part in a two part experiment and that the strategies they used to solve the first part might be very helpful in solving the second task. These instructions were given both to team members receiving relevant (four-disk Tower of Hanoi) training and irrelevant training (Eight Puzzle). These instructions were aimed at addressing the possibility that females weren't remembering information from the relevant practice session because they thought this would be their only task.

Using ten teams in each of the conditions, this study did result in significant differences in team performance such that those teams including a female who received the extensive training and strategy instructions performed better than teams where both members received irrelevant training. The difference was obtained both for number of moves and total time taken to solve the puzzle. In the context of the anomalous initial results of Barker (1995),

these new instructions essentially have corrected for a possible problem in manipulation of practice as an independent variable in his original study.

One common element in team construction is that teams typically have someone in charge: a team leader. The leader might be the pilot in command of an aircraft, the surgeon in charge of the surgery team, or the human resources manager leading a business team. Although the team leader is the person "in charge", each team member brings certain skills, expertise, and valuable information and knowledge. Most studies have not used experts in a particular domain when addressing decision making. Chi, Glaser, and Farr (1988) defined experts in a domain as better able to figure out the situation quickly, realize what information is relevant, and use effective strategies to solve the problem. The difference in knowledge each member brings to the decision making task has been termed distributed expertise (Hollenbeck et al., 1995).

In teams with distributed expertise, does it matter who has the knowledge and background training? Will the team perform the same if a non-leader receives the relevant training instead of the leader? One goal of this study was to determine whether team performance varies depending on whether the leader or the non-leader received the relevant

practice. When the team leader was not trained, team performance is based on the trained non-leader's ability to identify the relevant cues. Performance is also dependent on the non-leader convincing the leader what is the proper approach to solve the puzzle. When the team leader is trained and not the other member, the team leader must again accurately weigh the non-leader's inputs for the decision. The leader has the knowledge of the relevant cues and should base the decision on his or her own expertise. Unlike the Hollenbeck et al. (1995) study where each team member possessed some critical knowledge or expertise in a specific portion of the problem, this study addressed the effects of only one team member having relevant experience with the task. Since the leader is responsible for all of the team decisions, intuitive knowledge would predict teams with the leader trained would perform better than teams with the non-leader trained.

Given the same level of practice and relative knowledge in a domain, are females as effective in a leadership position as males? Unlike 30 years ago, mixed gender teams now permeate the work force. Females now lead surgery teams, serve as aircraft commanders, and hold top managerial positions. Are these females effective leaders when males are the other team members? The current study addresses how

the gender of the leader impacts team decision making and performance. Differences in performance based on the gender of the non-leader were also examined in this study.

The findings from the second pilot study offer a corrected paradigm to further study key issues related to team decision making. The current study also re-examines the differences in team decision making associated with different gender combinations but now using the strategic relevant practice instructions. These instructions should provide a better basis for comparing teams in which either a male or female member receives training. Previous findings of males performing better than females on the computerized Tower of Hanoi suggest that teams with the male receiving training will perform better than teams with the female receiving training.

Method

Participants

One hundred and ninety two students paired in 96 teams participated in this study in partial fulfillment of a course research participation requirement or for extra credit. All participants agreed to the conditions outlined in the informed consent form approved by the Institutional Review Board (Appendix A).

Apparatus

For the irrelevant practice condition, an Eight Puzzle was used. The Eight Puzzle consists of eight squares that slide into an open space in a 3 x 3 matrix. The puzzle depicts a picture of a cat when completed. At the beginning of each solution attempt, the pattern is scrambled by the experimenter. A wooden 4-disk version of the Tower of Hanoi consisting of three dowels connected to a rectangular base was used for the relevant practice condition.

A computerized version of the Tower of Hanoi called the Stack of Blocks was used for the team task. The Stack of Blocks was created using Toolbook software running on an IBM compatible computer with a 14 inch monitor. The Stack of Blocks uses blocks instead of disks or rings used in traditional Tower of Hanoi puzzles. The three bases are labeled A, B, and C and the blocks are numbered from large to small and colored differently.

Design

The variables of interest in this study include gender mix of the teams, gender of the team leader, gender of the non-leader, and whether the leader or non-leader was trained. The dependent variables were the number of moves, total time taken to complete the computerized Tower of Hanoi

puzzle, and the average time per move to complete the puzzle.

The participants signed up for the experiment on an individual basis in response to requests for participants of a particular gender. There was no prior indication of the gender mix of the teams to which the participant might be assigned. From these individuals, the team compositions were either male-male, female-female, or male-female. The time slots for the different gender pairings were randomly determined prior to the experiment. One member of each team was randomly designated as a team leader and the other a non-leader resulting in four possible team pairings: female leader-female non-leader (Ff), female leader-male non-leader (Fm), male leader-male non-leader (Mm), and male leader-female non-leader (Mf). One of the team members always received relevant practice and one received irrelevant practice.

The four treatment conditions were further divided into separate training conditions based on which member received relevant practice. For each of the four team groupings, there was a leader trained condition where the leader received relevant practice with the non-leader receiving irrelevant practice. In addition, for each of the team groupings, there was a non-leader trained condition, the

leader received the irrelevant practice and the non-leader received the relevant practice. The combination of four team types and two leader training conditions result in eight experimental conditions as described in Figure 1. Twelve teams were randomly assigned to each of the eight possible conditions.

Gender of Leader	Gender of Non-leader	Trained Member
Male	Male	Leader
		Non-Leader
	Female	Leader
		Non-Leader
Female	Male	Leader
		Non-Leader
	Female	Leader
		Non-Leader

Figure 1. Experimental Design

Procedure

Participants were initially directed to two separate laboratory rooms and completed the informed consent form. Based on pre-determined condition assignments, one participant completed the irrelevant practice task, Eight

Puzzle, and one completed the relevant practice task, 4-disk Tower of Hanoi, each task continuing for 10 minutes. In both practice conditions, the participants were told that this was the first part of a two part experiment and that the strategies they use to solve the first part of the experiment might be very helpful in solving the second half of the experiment. At the beginning of the instructions, each person was also told whether he or she would be the leader or the non-leader for the team task.

The participant completing the Eight Puzzle was instructed to try to arrange the blocks to recreate a picture of a cat as quickly as possible and as many times as possible in ten minutes (Appendix B). In the instructions for the relevant practice condition, the participant was given the rules for solving the Tower of Hanoi (Appendix C). Only one disk can be moved at a time and it must be the disk on the top of a stack, and a larger disk may not be placed on top of a smaller disk. The participant was also given strategies on how to solve the Tower of Hanoi. The instructions included a moving strategy for the disks based on whether there is an odd or even number of disks. The instructions also explained the moving pattern for the smallest disk. The experimenter demonstrated both strategies using the wooden Tower of Hanoi. After the

demonstration, the participant was given ten minutes to solve the puzzle as quickly as possible and as many times as possible.

The number of times participants completed their respective puzzle was recorded by the experimenter. Following the ten minute practice session on either the relevant or irrelevant task, participants completed a written retrospective protocol asking them to remember their thought processes during the task (Appendix D). Participants were instructed to actually describe what they were thinking about while they were completing the puzzle.

After completing the ten minute practice sessions, the participants were directed to another room to complete the team portion of the experiment. At this point, team members were introduced for the first time. The team leader was also confirmed. The individuals were seated next to each other in front of the computer screen with the team leader sitting on the right side to designate his or her leadership role. The participants were not told that they had completed different tasks in the first portion of the experiment.

Instructions for the team task were presented both visually and auditorially. The participants were told the three rules for the computerized version of the Stack of

Blocks (Appendix E). Only one disk can be moved at a time and it must be the disk on the top of a stack, and a larger disk may not be placed on top of a smaller disk. The third rule for the computer version is that the experimenter would make all of the moves as directed by the team leader. The instructions made it clear that only the team leader could give move instructions to the experimenter. All move instructions began with "Megan move" to ensure there was no confusion between team discussion and the actual move instructions to the experimenter. The instructions emphasized that it was a team task and the participants should work together to solve the problem. The computer recorded the total number of moves and the time taken for each move during the trial.

Upon completion of the computerized team task, participants were asked to complete a written retrospective protocol similar to the first part of the experiment. Participants were also asked to complete a satisfaction survey relating to the team interactions while solving the task (Appendix F).

Results

Objective performance data were collected by the computer for each team. The total number of moves, total time for completion of the puzzle, and the average time per

move were recorded as the team solved the computerized Tower of Hanoi. Gender of the leader, gender of the non-leader, and whether the leader or the non-leader was trained were analyzed using a 2 x 2 x 2 ANOVA (Leader Gender x Non-leader Gender x Training). The results were computed for the dependent variables of number of moves, total time, and average time per move while the team completed the puzzle. Each of the dependent variables will be addressed separately. It should be noted that neither number of moves nor total time is the best reflection of performance as the instructions requested the team to complete the task as quickly as possible in as few moves as possible. It should also be noted that the three dependent variables are not independent of each other as the average time per move variable involves both the total time and the total number of moves variables.

Table 1 provides the mean number of moves (and standard deviations) to complete the computerized Tower of Hanoi for gender mixes, leadership, and training conditions. While there were noticeable differences among the conditions, no significant main or interaction effects were found for the total number of moves taken to complete the puzzle.

Total time in seconds to complete the puzzle (and standard deviations) for each of the experimental conditions is shown in Table 2. The cell containing female-female teams where the non-leader is trained appears noticeably larger than all of the other cells. Interestingly, this is the same team combination that completed the task in the

Table 1. Means and Standard Deviations of Number of Total Moves by Gender Mix, Leadership, and Training Condition

	Leadership Condition		
Gender Mix	Leader Trained	Non-Leader Trained	Total
Mm	51.42 (15.28)	52.5 (14.74)	51.95 (14.69)
Ff	57.08 (20.46)	49.67 (17.29)	53.37 (18.91)
Fm	59.75 (18.69)	58.42 (25.05)	59.083(21.63)
Mf	57.5 (24.91)	55.92 (14.76)	56.71 (20.04)

Capital Letter Designates Team Leader

fewest number of moves (Table 1). For the dependent variable of total time taken to complete the computerized Tower of Hanoi, a significant main effect was found only for gender of the non-leader ($F(7,87) = 5.756$; $p < .02$). This main effect of gender of the non-leader indicates that it

takes significantly more time to complete the Tower of Hanoi for teams with female non-leaders than for teams with male non-leaders. When males were the non-leader of the team, the average total time was 483.42 seconds. This average was 599.31 seconds for teams with a female non-leader. Figure 2 depicts a graphical representation of this difference further broken down by gender of the leader.

Table 2. Means and Standard Deviations of Total Time in Seconds by Gender Mix, Leadership, and Training Condition

	Leadership Condition		
Gender Mix	**Leader Trained**	**Non-Leader Trained**	**Total**
Mm	439.67 (215.17)	453.00 (207.38)	446.33 (206.78)
Ff	539.75 (223.53)	725.75 (296.0)	632.75 (273.54)
Fm	535.33 (185.35)	505.67 (218.39)	520.50 (198.67)
Mf	536.42 (279.81)	595.33 (246.68)	565.88 (259.72)

Capital Letter Designates Team Leader

The average time taken per move in seconds (and standard deviations) is presented for each condition in Table 3. For this dependent variable, an interaction between gender of the non-leader and whether the leader or

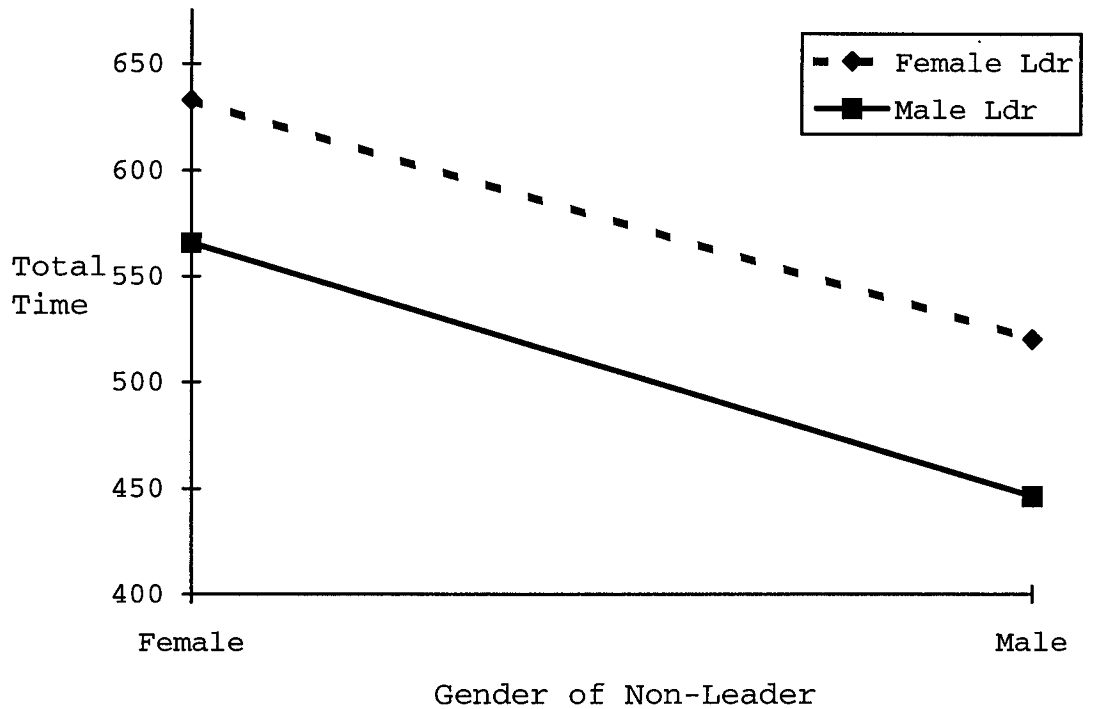

Figure 2. Time Taken to Complete Puzzle by Gender of Non-Leader.

non-leader was trained approached significance ($F(7,87) = 2.876$; $p = .09$). Additionally, whether the leader or the non-leader was trained also resulted in differences which approached significance ($F(7,87) = 3.154$; $p = .08$). This implies that those teams where the leader was trained had lower or faster average times per move than those teams with the non-leader trained. Figure 3 shows both this trend toward an interaction and the trend suggesting a main effect of whether the leader or non-leader was trained.

Table 3. Means and Standard Deviations of Average Time per Move in Seconds by Gender Mix, Leadership, and Training Condition

Leadership Condition

Gender Mix	Leader Trained	Non-Leader Trained	Total
Mm	8.42 (3.48)	8.61 (2.79)	8.52 (3.09)
Ff	9.87 (3.89)	15.12 (6.13)	12.49 (5.69)
Fm	9.12 (2.42)	9.07 (3.61)	9.09 (3.01)
Mf	10.02 (6.16)	10.84 (4.23)	10.43 (5.19)

Capital Letter Designates Team Leader

The average time per move is essentially the same for all of the groups. The only difference lies in the female-female teams where the non-leader is trained. The female-female teams where the leader was trained were significantly faster in average times per move solving the puzzle than those female-female teams where the non-leader was trained ($t(22) = 2.51$; $p = .02$). This difference is clearly apparent in Figure 3. The other visual difference found for teams with a male leader and a female non-leader and whether the leader or non-leader was trained was not significant ($t(22) = .38$, $p = .70$).

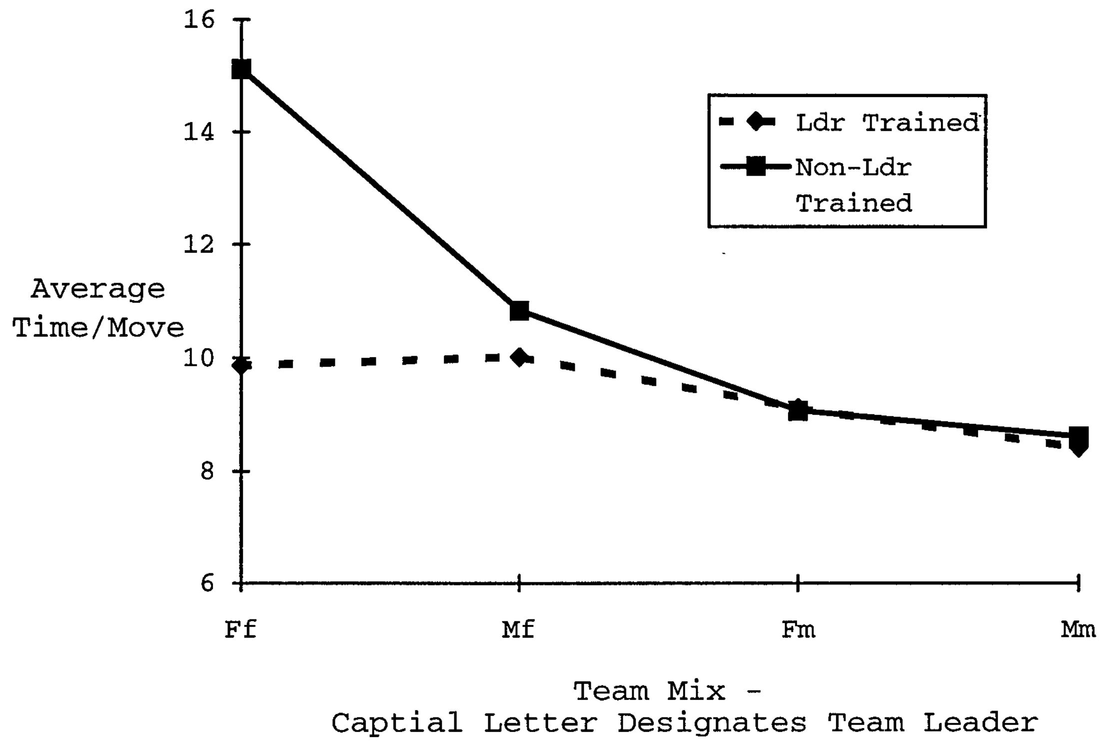

Figure 3. Average Time per Move of Gender Pairs by Training Condition.

A significant main effect for average time per move for gender of the non-leader was again found ($F(7,87) = 9.227$; $p < .01$). This main effect of gender of the non-leader for average time per move indicates that those teams with female non-leaders had longer average times per move than those teams with male non-leaders. This relationship is graphically depicted in Figure 4. When interpreting this significant finding, it is important to keep in mind the nearly significant interaction depicted in Figure 3. Most of the difference lies within the female-female teams.

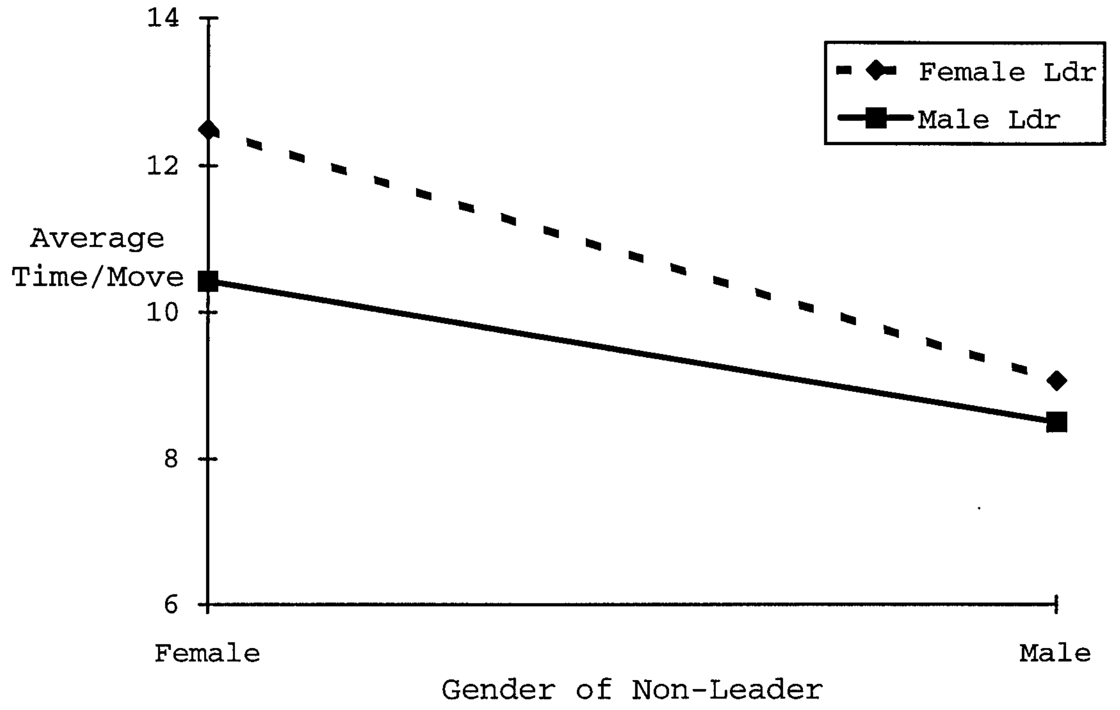

Figure 4. Average Time per Move To Complete Puzzle by Gender of Non-Leader.

In addition to looking at the main, several specific comparisons were conducted based on overall interest. One question of general interest is the relative performance in teams involving different gender compositions. When comparing female-female teams with male-male teams, there were no significant differences found in the number of moves to complete the Tower of Hanoi task. However, significant effects were found for both total time taken to complete the puzzle ($F(7,87) = 7.093$; $p = .01$) and average time per move ($F(7,87) = 9.067$; $p < .01$). Female-female teams completed the puzzle in an average of 632.75 seconds with male-male

teams completing it in an average of 446.3 seconds. The average time per move for the female-female teams was 12.5 compared to 8.51 for the male-male teams. Although this difference is reliable, as pointed out in Figure 3, this difference is located in the contrast between female-female teams with the leader trained and female-female teams with the non-leader trained.

Same gender teams were also compared to mixed gender teams. When comparing homogeneous teams to heterogeneous teams, there were no differences found in total moves, total time, or average time per move to complete the puzzle.

Retrospective written reports were taken from all participants after completing the computerized Tower of Hanoi task to address what the participants were thinking while they were solving the puzzle. These reports were analyzed for any valuable information on the task and decision making process. Most of the participants wrote only a half page of information following the team task. Although these reports were not analyzed in depth, there were several comments that were frequently conveyed by the groups. These comments included: (a) thought problem was harder with five disks, (b) tried to remember the strategies taught on the first task, (c) fear of breaking norms, (d) agreed to moves knew were wrong, (e) waited for the leader

to come up with the solution, (f) tried to visualize a pattern or sequence, (g) happy to have a partner, (h) did not want to seem overbearing. Although these comments are interesting, since there was not much data provided, only this superficial level of analysis was conducted.

Team Satisfaction surveys were also administered to the participants after they completed the team Tower of Hanoi task. These surveys indicated how each participant felt about the quality of team interactions during the problem solving process (Appendix F). 93 percent of the participants rated the team interactions as Good to Very Good (ratings of 3 to 5 on a 5 point scale). These ratings indicate that most of the participants were satisfied with their team interactions. Additionally, when comparing one team member's rating to the other team member's rating, 85 percent of the participants rated the quality of team interactions the same or within one point difference of their partner.

Discussion

In this study, there were no differences between the teams where a female was the leader and those teams where a male was the leader in terms of the total number of moves, total time in seconds, and the average time per move to complete the team task. This implies that the gender of the

leader does not impact the team decision making process for this task.

Interestingly, the gender of the non-leader did impact the total time and average time per move for the teams. The teams with a female non-leader were slower and had a longer average time per move than those teams with a male non-leader regardless of the gender of the leader and which team member received relevant training. The decision making of the team was hindered when there was a female non-leader. In terms of the Hollenbeck et al. (1995) study, it might be that females are less likely to provide valuable information when they are designated as a non-leader. Males are more apt to offer relevant information even when they are termed the non-leader.

In interpreting this finding, the reader should be aware that this difference is most drastic for female-female teams (Figure 3). Among the female-female teams, when the leader was trained, the team performed faster than when the non-leader was trained. Females may have taken the position of leader or non-leader more seriously and acted within their set of norms for their specific leadership position. The non-leader was not actually making any decisions, so she may have not provided the information about the strategies she learned during the training session to solve the team

puzzle. In terms of Hollenbeck's et al. (1995) findings, the female non-leader did not share the relevant information on solving the task of which only she had the knowledge. When the leader was the trained member of the team, the team performed similar to the other gender combinations in terms of number of moves, total time, and average time per move. These findings are consistent with Hollenbeck's et al. (1995) theory of team decision making in that the success of the team depends on the degree that team members share relevant information about the task.

To the extent that differences were found between female-female teams and male-male teams in speed of completing the Tower of Hanoi, these data are consistent with prior research. Both Barker (1995) and Leon-Carrion et al. (1991) found that males were faster and took less moves to solve the computerized Tower of Hanoi. Surprisingly, in this study, mixed or heterogeneous teams did not differ from homogeneous teams. Those teams with a male and a female performed similar to the homogeneous teams. This variance from Barker's (1995) earlier findings of teams with a female member performing poorer than those teams with two male members could be due to the strategic instructions versus just practice on the wooden Tower of Hanoi task. With the strategic instructions, having two females working together

slows down performance when the non-leader was trained, but having a male and a female as a team does not hinder performance.

This study in combination with other research suggest there are situations where females do not bring valuable information into a team task. This was found true in the laboratory, but what about naturalistic settings? Further research is necessary to determine if this effect is found in real life situations.

There are several limitations to the methodology used in this study. In naturalistic settings in contrast to the laboratory, there is usually more at stake regarding the performance of the team. The teams in this study may not have taken the task quite as seriously since they had nothing riding on the results. The participants were also completing the task with someone they did not know. This is not usually the case in real life. When serving on work teams, the members know each other and the team works together for more than one fifteen minute stint. All of these factors may have influenced the results and beg for further investigation. The task in this study was also a spatial task which research has shown favors males over females.

Training of the leader or non-leader only seemed to impact the female-female teams. However, in this study, the training was somewhat cursory and did not make the trained person an expert on the task. This could explain why the training of the leader or the non-leader did not influence the results for the other gender combinations. Additional research with more in-depth training would provide more generalizable results because most teams include members who are considered experts in their functional area. Providing the participants with some kind of team training may also impact the results.

This study does provide useful information on team decision making. The results suggest that gender and status issues do impact team decision making on this particular spatial task. Although this report provides valuable data, there are still many questions to be answered by further research into team decision making.

APPENDIX A

INFORMED CONSENT FORM

I freely and voluntarily and without any element of force or coercion, consent to be a participant in the research project entitled "Team Decision Making".

It is being conducted by Megan E. Bird, M.A., who is a graduate student in the Psychology department at Florida State University. I understand the purpose of his research project is to better understand how teams make decisions. I understand that if I participate in this project my conversations will be recorded while working on the experiment with another student.

I understand my participation is totally voluntary and I may stop participation at any time. All my answers to the questions will be kept confidential and identified by a subject code number. My name will not appear on any of the results. No individual responses will be reported. Only group findings will be reported.

I understand that there are no risks involved, but I may stop my participation at any time I wish.

I understand there are benefits for participating in this research project. First, I will learn about conducting psychological research. Also I will help researchers better understand factors that impact team decision making. This may in turn help to improve areas where teams make decisions such as airline crews and hospital surgery teams.

I understand that I may contact Megan E. Bird at the Florida State University Psychology department, KRB-128, (904) 644-4382, for answers to questions about the project. Group results will be sent to me upon my request.

I understand that this consent may be withdrawn at any time without prejudice, penalty or loss of benefits to which I am otherwise entitled. I have been given the right to ask and have answered any inquiry concerning the study. Questions, if any, have been answered to my satisfaction. In the future, I understand I may contact Megan E. Bird., Florida State University Psychology Department, KRB-128, (904) 644-4382, for answers to questions about this research or my rights. I have read and understand this consent form.

NAME______________________________SSN# ________________________
DATE__________ GENDER_____________ AGE _____
PSY 2012 Section (or Instructors name)_______________________________
Participant Number ___________________(completed by the experimenter only!)

Florida State
UNIVERSITY

Office of the Vice President
for Research
Tallahassee, Florida 32306-3067
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RENEWAL MEMORANDUM January 6, 1997

TO: Megan Bird
(Psychology)

FROM: Betty Southard, Chair BS/hh
Human Subjects Committee (IRB)

Re: Reapproval of project entitled: Team Decision Making

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by January 23, 1998, please request renewed approval.

You are reminded that a change in protocol in this project must be approved by resubmission of the project to the Committee for approval. Also, the principal investigator must report to the Chair promptly, and in writing, any unanticipated problems involving risks to subjects or others.

By copy of this memorandum, the Chairman of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols of such investigations as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

BS/hh
cc: G. Weaver/1051
human/renewal.hs
APPLICATION NO. 95 417

APPENDIX B

Irrelevant Practice Instructions - Eight Puzzle

- This is a two part experiment. Your first task will be solving the Eight Puzzle. In the second part of the experiment there will be designated leader and non-leader. The leader will be responsible for all team decisions. For the second part of the experiment, you will be the ______________ (either leader or non-leader).

- For the next 10 minutes I would like you to work on solving the puzzle in front of you. The goal is to move the blocks so they recreate the picture in front of you. Do this as quickly as possible but also in as few moves as possible. The strategies you use to solve this puzzle might be very helpful in the second part of the experiment.

- Any questions?

- Please begin.

APPENDIX C

Relevant Practice Instructions - Tower of Hanoi

Welcome to Stack the Disks otherwise known as The Tower of Hanoi. This is a 2 part experiment. Your first task is to solve the Stack of Disks. In the second part of the experiment there will be designated leader and non-leader. The leader will be responsible for all team decisions. For the second part of the experiment, you will be the ______________ (either leader or non-leader).

Your goal is to move all of the disks from Peg A to Peg C as quickly as possible and in the minimum number of moves. There are 2 rules that you must follow when making moves. First, you can only move one disk at a time and it must be the disk on the top of a stack. Second, you can not place a larger disk on top of a smaller disk. (Demonstrate both violations). Do you understand these rules?

This minimum number of moves changes depending on how many disks are in the stack. The minimum number of moves for a stack of 3 disks is 7. The minimum for 4 disks is 15.

I'm going to explain a moving strategy for the disks that you should use while solving the puzzle. This strategy is very important to remember and may be needed in the 2nd part of the experiment.

The smallest disk will be moved every other turn. You need to remember that the smallest disk goes from A to one of the other pegs, then to the third peg and finally back to A in a continuous cycle. (Demonstrate). This will be done in a continuous cycle until the complete stack of disks is moved from Peg A to Peg C

It is critical to remember that the 1st move is made based on the number of disks in the stack. If the number of disks is odd, the smallest disk is moved to Peg C first. It will then be moved to Peg B and back to Peg A on alternate turns. This rotation from C to B and back to A continues until the puzzle is solved. If the number of disks is even, the smallest disk is moved to Peg B first, then to Peg C and back to Peg A. (Demonstrate).

Do you understand this strategy? Let me demonstrate one time.

You will now have 10 minutes to practice. I will be keeping track of how many times you complete the puzzle, so remember your goal is to move all of the disks from Peg A to

Peg C as quickly as possible and in the minimum number of moves. The strategies you use to solve this puzzle might be very helpful in the second part of the experiment.

Any questions?

Please begin.

APPENDIX D

Retrospective Protocol - All Practice/Testing Conditions

Now I want to see how much you remember about what you were thinking from the time that I gave you the task and when you were finished. I am interested in what you actually can remember rather than what you think you must have thought. If possible, I would like you to tell about your memories in the sequence in which they occurred while working on the problem. Start with your memories from when you first began and work forward. Please tell me if you are uncertain about any of your memories. I don't want you to re-work the problem again, just report all that you can remember thinking about. Now for the next 3 minutes, write down everything that you can remember. Continue on the back of this sheet if necessary.

APPENDIX E

Computerized Stack of Block Team Instructions

Whoever is the leader of the team needs to sit in the right chair.

Screen 1

Welcome to the stack of blocks. Your goal is to move the stack of blocks from base A to Base C as quickly as possible in the minimum number of moves.

Screen 2

There are 3 rules that you must follow while completing this task

Screen 3

Rule # 1. You can only move 1 block at a time and it must be on the top of a stack

Screen 4

Rule #2. You can not place a larger block on top of a smaller block

Screen 5

Rule #3. The experimenter will make all of the moves according to your instruction.

For example if you want to move Block 1 to Base B. Say move 1 to B

Screen 6

And block 1 will be moved to Base B. If you want Block 1 on top of Block 4, just say move 1 to 4

Screen 7

And block 1 will be stacked on top of Block 4.

Although one of you is the leader of the team, this is a team exercise so discuss moves and work together to complete this problem.

Screen 8

Warning. Only the team member who is designated as the Team Leader may give move instructions to the experimenter. Begin each move instruction with "Megan Move" and then your move. This will avoid any confusion while you and your team member are discussing the moves

Screen 9

Remember you are trying to complete the task as quickly as possible in the minimum number of moves.

Do you have any questions?

Please let the experimenter know when you are ready to begin.

APPENDIX F

Team Satisfaction Survey

How would you rate the quality of your team's interaction in solving this puzzle?

Very Good		Good		Poor
5	4	3	2	1

Please provide any comments about your team's interaction in solving the puzzle:

In the interest of research on Team Decision Making, please do not discuss any aspect of this experiment with anyone until the end of the semester.

Participant #________

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BIOGRAPHICAL SKETCH

MEGAN E. BIRD

[redacted] [redacted]

EDUCATION: M.A. The George Washington University, Human Resource Development, 1995

B.S. United States Air Force Academy, Organizational Behavior, 1989.

PROFESSIONAL EXPERIENCE: Capt, U.S. Air Force
Managed personnel programs for over 2,900 personnel. Responsible for on-the-job training, job classification, personnel resources, training, personnel readiness for wartime activities, retirements, separations, promotions, performance reports, and professional development. Supervised up to 15 personnel. Managed $800,000 budget.

RESEARCH EXPERIENCE: Co-authored "Competition, Cooperation, Satisfaction, and the Performance of Complex Tasks Among Air Force Cadets published in Current Psychology: Research and Reviews.

Presented Above Paper at Psychology in the Department of Defense Conference - 1990.

Revised Articles at the Defense Equal Opportunity Management Institute - 1988

"A Review of Data on Women in the United States"
"The Service Academies as a Source of Minority and Female Officers"